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THE VETERINARY JOURNAL

A Monthly Review of Veterinary Science.

Editor:
FREDERICK HOBDAY, F.R.C.V.S., F.R.S.E.,
HONORARY VETERINARY SURGEON TO HIS MAJESTY THE KING.
MAJOR IN THE ARMY VETERINARY CORPS.
HONORARY MEMBER OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION.
CORRESPONDANT ÉTRANGER DE LA SOCIÉTÉ DE MÉDECINE VÉTÉRINAIRE DU BRABANT (BELGIUM).

Sub-Editor:
GLADSTONE MAYALL, M.R.C.V.S.

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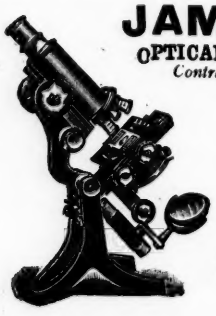

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Sub-Editor :

GLADSTONE MAYALL M.R.C.V.S.

MARCH, 1918.

Editorials.

THE DISEASES OF FOWL AND FISH.

THE poultry stock of this country represents no inconsiderable amount of capital value, and the revenue derived from fish is a very big one. It seems likely that before we are through with the difficult times here that we shall have to make heavy calls on creatures that swim and fly. It has been suggested that a good store of food lies to hand in the eggs of sea-fowl, and that this source may be tapped almost without limit. Those who have ever eaten the eggs of the water-hen, or plover, know how palatable they are, and there is little doubt that the eggs of the marine and aquatic birds that surround our coasts will come in very acceptable if an organised plan of collecting and distributing them is devised.

Considering the importance of fish and fowl it only accentuates the statement recently made by a discerning lady—" there is a big vein of laziness in the Britisher's disposition "—that little research has been made in the diseases of these creatures, and that as veterinarians we are not as well up in their complaints as we ought to be. Both furnish means of quickly, easily, and cheaply increasing the food supply of the country. The increased breeding of ducks and geese will also help. Feeding problems with regard to them must be overcome by intelligence and foresight and it is rather a sign of muddle and inefficiency that any difficulty occurs in the matter.

Recently an enquiry was made about aspergillosis in birds, and not long ago a gentleman stated that " nobody knew anything about swine fever." In the one case it appears as if investigation is in

its infancy, whilst in the other it looks as if "much study is only a weariness of the flesh."

Many diseases of fish and fowl will pay for investigation. Furunculosis of fish is a disease which causes considerable loss. It is characterised by hæmorrhagic inflammation of the bowels and bleedings in different organs, especially in the muscular tissue and spots and ulcerations in the skin. In closed waters one way of destroying a considerable number of the bacteria which cause the spread of the disease is the use of potassium permanganate in dilute solution which does not injure the fish. Fishing out and selling the sound stock is another way of dealing with the malady. We do not think it has been conclusively proved that furunculous fish never transmit disease to man, and it may be worth while investigating fish supply as a possible source of some of the crops of small boils that not a few men who have been on active service have suffered from. In any case a different view of the likelihood and possibility of infection or contagion from fish to animal may be taken from that from fish to man. We ourselves have seen a peculiar disease in ponies characterised by crops of nasal, oral ecchymoses and pustules and perineal pustules, and raised discharging patches on the skin; and in all the cases the ponies were engaged in carting fish and frequently licked fishy surroundings and damp fish carts. They entered yards where fish were gutted and cleaned.

Aspergillosis of birds is hard to cure, but now and then birds recover by applying flowers of sulphur or tincture of iodine to the patches that can be reached, and letting the fowls inhale the vapours of tar water or turpentine in a closed room

Black head, white comb, roup, coccidiosis, white diarrhœa of chicks, fowl cholera, and chicken pox are all infectious diseases which need further investigation and research work conducting on them.

The prevention of disease, however, is always more important than its treatment where poultry are concerned. The veterinarian must not only be able to diagnose and suggest remedies in diseases of poultry, but to enlighten the owner as to the best way to prevent infectious complaints. Good eggs from healthy flocks, clean incubators, small flocks, sound ground, cleanliness, and disinfection, clean food and water are all of importance in the rearing of healthy profitable fowls.

G. M.

MILK.

THERE are a good many matters in connection with milk that need probing and settling. In many Continental countries the veterinary surgeon takes a far more prominent part with regard to

milk than he does here—he is consulted oftener by those in difficulties with their supply and he has a greater say and influence in questions affecting its production and distribution. Considering its importance as a foodstuff and the vital necessity of an adequate quantity we think too little time, effort and money have been devoted to a consideration of the many points in connection with it by those concerned in this country.

If we knew more about how the fluid is secreted in the healthy udder of a cow milk supply might benefit considerably in quality and quantity.

The prevalent theories at present are that milk is formed directly from the blood, the gland merely acting as a filter ; that it is the product of the decomposition of epithelial cells ; a third theory—which has most evidence to support it—is that milk secretion is due to a specific activity of the gland cells of the udder through which the constituents brought to the gland in the blood stream undergo a certain chemical change and thus the definite product called milk is formed. In other words, milk is formed by blood constituents and cell activity in the gland.

Variations in genuine milk need further investigation. It ought not to be difficult to lay down a definite limit within which milk as it comes from the cow may vary in fat contents and solids not fat.

Speaking with a representative farmer in this district a few weeks ago, he said he was certain that genuine milk never varied more than 2 per cent. in fat contents. Incidentally he also said that he had created heated arguments at meetings of farmers where he had stuck to his guns on this question. A consideration of available literature seems to indicate that this farmer's contention is absolutely true, and well within the mark, but no direct work seems to have been undertaken with a view to proving it.

We all know that prolonged drought or excessive rainfall affects the quality of milk and most of us think that a high wind is not beneficial for milk secretion. The veterinary surgeon ought to be in a position to settle some of these points definitely when disputes arise between those who know and those who do not know.

Inasmuch as nervous influences play a great part in milk secretion, prosecutions of farmers and milk producers ought not to succeed where it is found that cows have suffered from shell shock or been greatly and repeatedly affrighted by low flying aeroplanes.

The employment of more veterinary surgeons to authoritative positions in connection with cows and milk is all for the benefit of milk knowledge, and those who are engaged in the production and distribution of the food.—G. M.

Original Communications.

GENERALISED SARCOMATOSIS OF THE FOWL.

By B. F. KAUPP, Pathologist,
N.C. Experiment Station, W. Raleigh, N.C.

THE records of this laboratory show that of 730 autopsies held upon hens and cocks ranging in age from twelve months to three years, 8, or a trifle over 1 per cent., were affected by generalised sarcomatosis. Round-celled sarcoma is the most prevalent type, and round-celled lympho-sarcoma is frequently observed.

A sarcoma is a connective tissue tumor whose elements, either because of their number or often because of their size, predominate over the intercellular substance. Sarcomata are closely related to the undeveloped connective tissue, so that sarcomatous may be compared with embryonal tissue.

Sarcomata develop either in previously normal tissue belonging to the connective tissue group—as, for example, in the skin, subcutaneous tissue, intermuscular connective tissue, periosteum, spinal cord, meninges, connective tissue of glands, and other similar locations. It may also develop in some pre-existing connective tissue tumour, as in fibroma, myoma, or chondroma.

The sarcoma cells may be of a small or a large round-celled variety or they may be of small or large spindle cells, or a mixture of these two principal varieties.

The first case here recorded was in a Barred Plymouth Rock cock.

History.—A Barred Plymouth Rock cock, from a breeding pen; age, 15 months; leg band, No. 178. This bird had not been noted to be sick up to within three days before his death. During these last three days he appeared dull, ate very little, and died March 2nd, 1917.

Protocol.—Upon opening the abdominal cavity the liver was noted to be very much enlarged, weighing 146 grams., or four times its normal size. In the liver substance there were observed small, white nodules, the largest of which measured 8 mm. in diameter. The sectioned surface of the liver was soft and the new growths were not encapsulated. The proventriculus contained two nodules 10 mm. in diameter. Several small nodules were observed in the mesentery. One nodule was noted in the pectoralis secundus muscle; this nodule measured 2×3×13 mm. Several nodules were also observed in the heart muscle, the largest of which was 20 mm. in diameter. One small nodule was located in the spleen which measured 4 mm. in diameter. There were two small tumours located in the upper edge of the obturator internus muscle, one measuring 5 mm. and the other measuring 10 mm. in diameter. One nodule was observed in the first limb of

the duodenal loop; this nodule measured 2 mm. in diameter. One nodule was located in the left thoracic wall, which nodule measured 20×10 mm. There were two new growths involving the kidneys, one measuring 15 mm. in diameter, and the other 20 mm. in diameter. Fig. 1 shows the gross lesions of the various organs.

Microscopic Study.—Sections of the heart and liver were prepared and studied. Fig. 2 shows a section from the heart muscle in which there will be seen embryonic type small round cells invading the muscle. There is no limiting membrane or capsule. It is a small, round-celled sarcoma.

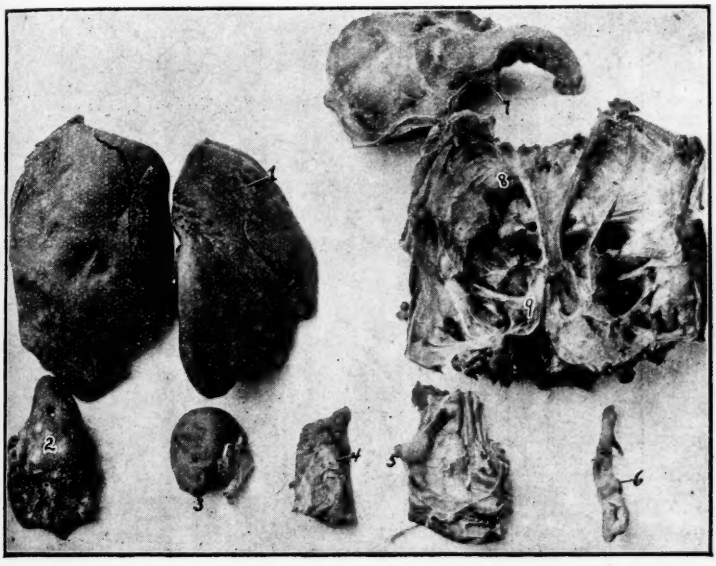


FIG. 1.—PHOTOGRAPH OF VISCERAL ORGANS OF BARRED PLYMOUTH ROCK COCK 15 MONTHS OLD. (1) Sarcoma of the liver; (2) sarcoma of heart; (3) sarcoma of spleen; (4) sarcoma of pectoralis secundus; (5) sarcoma of inner surface of the rib; (6) sarcoma of the wall of the small intestine; (7) sarcoma of the proventriculus and gizzard; (8) sarcoma of the edge of the obturator internus muscle; (9) sarcoma around the ischiadic artery.

The second case here recorded was in a Single Comb White Leghorn hen.

History.—A Single Comb White Leghorn hen, No. 101, hatched March 8th, 1916. She was a member of a pedigreed flock, and died May 1st, 1917. She began laying at the age of six months and produced, according to trap nest records, eight eggs in October, nine in

November, seven in December, none in January, and seven in February. The last egg laid in a trap nest was February 28th, 1917. The pullet appeared in fair condition, with an apparent tumefaction and ulceration just below the anus. She appeared in good health till a few days before her death.

Protocol.—The carcass was in thin condition. There was an absence of retroperitoneal fat. The tumour in the region of the anus measured 4·5×3×4 cm. in its three diameters. The surface was ulcerated and covered with a scab. The surface was somewhat irregular. The sectioned surface was whitish, soft, and liver-like in consistency.

FIG. 2.—PHOTOMICROGRAPH OF SECTION OF HEART FROM CASE SHOWN IN FIG. 1. (1) Round sarcoma cells; (2) muscle.

Two tumours involved the ovary; one measured 4×4×2 cm., the other 4 cm. in diameter. The appearance was the same as in the above tumour. The left kidney was practically all replaced by the neoplasm and was four times its normal size. The anterior and middle lobes of the right kidney were similarly affected; the posterior lobe showed no growth, but was reddish in colour and enlarged. Several tumours were scattered throughout the walls of the intestines; these varied in size up to 1·5 cm. in diameter. One tumour 1 cm. in diameter was located in the lower edge of the right lobe of the liver, and a growth had developed from the lower edge of the left lobe. This measured 7×3·5×3 cm., and was the largest of all. The appearance and con-

sistency of all were the same. Fig. 3 shows a photograph of this case.

Microscopic Study.—Sections from the liver and kidney were prepared and studied. This tumour was a small, round-celled sarcoma. Figs. 4 and 5 illustrate the small, round cells invading the liver tissue. At Fig. 2 can be seen the liver cells, which are pushed apart by masses of the small round sarcoma cells.

The third case here recorded is a Single Comb White Leghorn hen.

History.—This subject was a Single Comb White Leghorn hen hatched April 4th, 1916, and died April 14th, 1917. She laid one egg

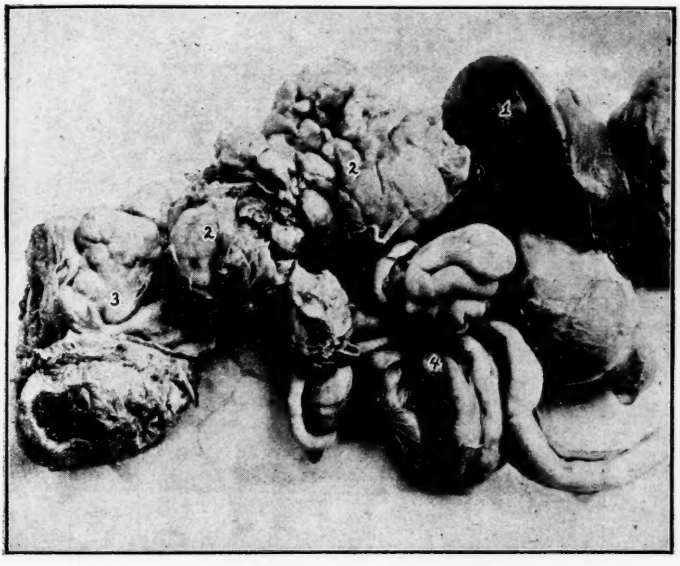
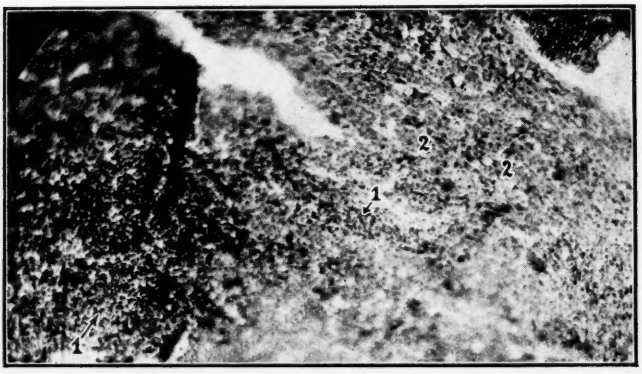


FIG. 3.—PHOTOGRAPH OF THE VISCERAL ORGANS FROM THE SECOND CASE, A SINGLE COMB WHITE LEGHORN. (1) Sarcoma of the liver; (2) Sarcoma of kidneys; (3) sarcoma of the rectum; (4) sarcoma of intestine.

in February and four eggs in March. These were all that the trap nest records show. She did not lay after March 29th, 1917.

Protocol.—The carcass had a somewhat unkempt appearance. There was very little retroperitoneal fat. The bird was thin in flesh. The head and unfeathered parts were normal, and there were no palpable tumours. Upon opening the abdominal cavity there were noted five tumours of the abdominal viscera. Two of these tumours were on the duodenal loop and measured 4×3×2 mm. in diameter.

There were also two tumours located in the wall of the cæcum. These tumours measured about the same as the preceding. There was one large tumour involving the wall of the free portion of the small intestine. This is shown in cut number 1, which is a photograph of the sectioned surface. The tumour is 6 cm. long, and the wall at 2 is 1 cm. thick. Fig. 6, letter A, shows at 1 the lumen of the intestine,



FIGS. 4 AND 5.—PHOTOMICROGRAPH SECTION OF LIVER FROM CASE SHOWN IN FIG. 3. (1) Round sarcoma cells infiltrating among liver cells; (2) liver cells.

which in the centre is filled with ingesta. Letter B shows the inner wall. There is to be noted a slight sacculation on the tumour side of the bowel. At 2 there is noted a perforation. At this point there is ulceration, but there was apparently no ingesta finding its way out

into the abdominal cavity. At this point there was adhering firmly to the intestine a fold of the mesentery. This section of the mesentery was thickened and showed some signs of inflammation.

Microscopic Study.—Sections were made and studied from the wall of the tumour of the bowel and from the section of mesentery. The major portion of the tumour consisted of cells of an embryonic type. The nuclei were large and the cytoplasm small in amounts.

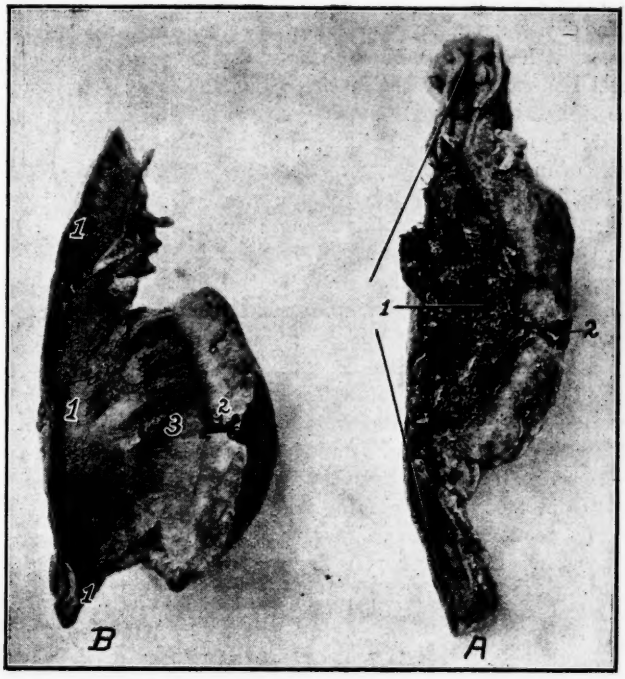


FIG. 6.—PHOTOGRAPH OF SARCOMA OF INTESTINE FROM CASE 3, showing at (1) lumen containing fæces; (2) a perforation communicating with the peritoneal cavity; (3) a diverticulum of the intestine.

There were a few strands of connective tissue along the inner portions of the tumour. This connective tissue may have been a remaining portion of the sub-mucous connective tissue. The balance of the tumour was free from connective tissue. The cells besides appearing like embryonic cells were of a large type, resembling those of a large-celled sarcoma and round in type. The portion of mesentery was infiltrated by similar cells.

INTUSSUSCEPTION IN THE DOG.

By A COUNTRY PRACTITIONER.

THE subject of the following case was an Airedale which I had received a message to visit. On arrival I found the history of the case to be as follows :—For some weeks past the dog had been subject to attacks of vomiting, which would last off and on for a few hours to a day or two, when during the attack he would appear dull and in pain but present no severe symptoms. The sickness would pass off and he would be all right until another attack occurred.

The owner was a lady who had lately come to visit this neighbourhood, and the dog had been under treatment previously. On my arrival I found the patient much easier than he had been and the sickness had abated. On enquiry, no worms had been seen to be passed ; he merely looked dull and listless. Thinking the case must be one of indigestion, I left some sedative powders of bismuth and sod.-bicarb., and he was given a dose of castor oil.

The next day he was brighter and appeared to ail very little. In two or three days he seemed all right, except that his appetite was not quite so good as usual.

In a few days more I got another message saying the dog was very sick again, and in great pain. Being 6 miles away it was some time before I got to see him, when he seemed easier, but much worse than he was the first time I saw him. The eyes were red, the nose hot, and he was dejected ; but still no severe pain.

I now began to suspect he must have some intussusception of the bowel, or a partial twist ; but the difficulty was how to account for the different attacks of vomiting and then apparent recovery continued over so long a period. However, in two or three days more an urgent message came, saying the dog was very ill and breathing very quickly.

On arriving I found him to be as described, and he had every appearance of pneumonia. The usual medicine was prescribed, but the case seemed hopeless. He died during the night.

Desiring to see if I could find out anything more definitely about him, I made a *post-mortem* next day. A small quantity of fluid was thrown out into the chest, and some in the pericardium, and the lungs were slightly inflamed. The bowels were pale in colour and nearly empty. In the duodenum I found the cause of the trouble, which was that a small portion of the bowel, about ½ inch, was intussuscepted, and the walls were thickened and red. With a slight pull this could be straightened out, and in attempting to put it back again as I found it, a little pressure had to be exerted ; then when it got past a certain point it went back with a rush. I did this several times.

Here evidently was the cause of the attacks of sickness and recovery. When intussusception took place the sickness came on. Then, the bowel straightening out again, he got ease and kept all right until the bowel slipped once more into itself. Apparently this had occurred several times.

Thinking this case must be somewhat unusual is the reason of my submitting it to you.

NOTES IN REGARD TO HORSE LICE, *TRICHODECTES* AND *HÆMATOPINUS.*

By MAURICE C. HALL, Ph.D., D.V.M.,
Parasitologist, Research Laboratory of Parke, Davis & Co., Detroit, Mich.

Horses are infested with two kinds of lice, the sucking louse, *Hæmatopinus asini* (*Hæmatopinus macrocephalus*), and the biting lice, *Trichodectes pilosus* and *Trichodectes parumpilosus.* The two forms are readily distinguishable, as the sucking louse is a larger louse with a long, pointed head and the biting lice are smaller forms with a blunt, rounded head. (See figures.) The sucking louse, as the term suggests, is a blood-sucker. The biting louse lives on the superficial epidermal scales and the debris and secretions present on the skin. The sucking louse is probably the more vicious pest of the two, as the loss of blood from the attacks of large numbers of these lice may be a serious matter. There is probably little difference in the degree or amount of annoyance due to the presence and irritation from the two different kinds of liee, but even here the puncturing of the skin by *Hæmatopinus* is perhaps more irritating than the biting of the superficial epidermis by *Trichodectes.* Both forms give rise to itching, and the results from this are often surprisingly unpleasant. A barn full of horses may become a pandemonium as a result of lice. The itching animals attempt to relieve the itching by rubbing and biting, other animals start to kick, presently the kicking becomes general and there is a resultant clamour and din, with a substantial element of danger to the horses and attendants. Occasionally the lice will give rise to eczema. Lice seem to be more numerous in late winter or early spring. They are more readily detected when horses stand in the warm sunshine, as this brings the lice to the surface. The sucking lice are especially easy to detect on white horses.

Many persons, writing on horse lice, discuss periods of treatment, remedies, and other matters for biting lice and sucking lice together, apparently on the bases that a louse is a louse, and, more especially, that a horse louse is a horse louse. But inasmuch as there is a rather wide gap between a sucking louse and a biting louse, the first belonging

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to the Hemiptera and the second to the Mallophaga, it might be safely assumed that there would be considerable difference between the two kinds as regards not only structure but also bionomics, and consequently details of treatment. A few very tentative experiments seem to confirm this idea.

In the purchase of hundreds of horses for the serum work of Parke, Davis & Co., there is more or less trouble as a result of the importation of lice on new purchases, and this problem becomes more acute in winter, when dipping is no longer feasible. During the summer lice may be readily controlled by dipping, a coal-tar dip furnishing a cheap and satisfactory means of freeing horses of lice. During the

SUCKING LOUSE.

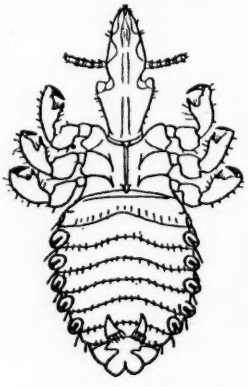

FIG. 1.—*Hæmatopinus asini* (*H. macrocephalus*) Female. x16. After Neveu-Lemaire (1912).

BITING LICE.

FIG. 2.—*Trichodectes parumpilosus*. Female. x14. After Neveu-Lemaire (1912).

FIG. 3.—*Trichodectes pilosus* (*Tr. vestitus*). Female. x14. After Neveu-Lemaire (1912).

HORSE LICE.

past winter the writer has assisted the veterinary staff at Parkedale and has undertaken a few rather simple experiments to obtain a little information which did not seem to be available. The principal object of this paper is to make those results available to others and to make public such findings as are in any way new.

In the first place, 38 horses were selected for examination for lice, taking those on which lice had been seen or where the restlessness or evidence of itching suggested the presence of lice. Of these horses, lice were found on 24, or 63 per cent., so that of cases presenting evidences of lousiness clinically, conviction in the shape of lice found was not obtainable in quite a number of cases. Of the 24 horses found infested with lice, 22, or 92 per cent., were infested

with sucking lice, *Hæmatopinus asini*, and only 2, or 8 per cent., were infested with biting lice, *Trichodectes pilosus*. The infestations with *Hæmatopinus* ranged from very light to very heavy; those with *Trichodectes* were both very heavy. It is interesting to note that Osborn (1891), contrary to our experience here, found the biting lice most common in Ohio at the time he wrote, and says of the sucking louse *Hæmatopinus*: "Notwithstanding the probable frequent occurrence of this species, we have as yet failed to meet with examples. The biting lice from horses have been secured in great numbers, but we have searched in vain for this one." Even five years later, Osborn (1896) writes of *Hæmatopinus*; "The biting lice have been secured in great numbers, but we have searched in vain for this one, and but few have come to hand." As regards the species of biting lice found, we are again at vairance. I found no specimens of *Trichodectes parumpilosus*, while Osborn (1891, 1896) says of *Tr. pilosus*: "We have not been fortunate enough to secure examples of this form, though we have the other in great abundance." The difference in Osborn's findings and our findings as regards the relative abundance of the two species of biting lice is paralleled in Europe, where Fiebiger (1912) has pointed out that Railliet considers *Tr. pilosus* the more rare, while Taschenberg considers it the more common of the two species. Neveu-Lemaire (1912) agrees with Taschenberg.

Experiments showed a great difference in the length of time the sucking lice could live off their host as compared with the biting lice. In a number of tests sucking lice, *Hæmatopinus*, lived one or two days, the last of them never surviving beyond the second day after their removal from the horse. On the other hand biting lice, *Trichodectes* lived from five to eight days, the last of them being found dead on the ninth day. One factor which may partly account for this is the fact that both species of lice were kept in vials with small amounts of the horse's hair, removed when the lice were collected. This hair perhaps furnished food for the biting lice, while the sucking lice, deprived of the blood which constitutes their food, speedily starved. In spite of this, the experiment indicates that stables are apt to be capable of infecting horses with biting lice for a period of at least eight days, at the temperatures noted below, even disregarding the presence of eggs, whereas stables would probably be incapable of infecting horses with biting lice after being kept empty for two or three days at these temperatures, if we disregard the presence of eggs. The presence of eggs in stables would depend largely on whether the horses involved were shedding or losing hair in other ways. There would seem to be little likelihood of the eggs becoming detached from the hairs. Newly-hatched lice of either the biting or sucking kinds died inside of two days

when kept off a host animal. I have no data in regard to the humidity conditions of these longevity experiments, and only the temperature range, which was from 21° to 31° C. (70° to 88° F.). The lice would probably live longer at lower temperatures.

Louse eggs may be readily distinguished from the eggs of the bot-flies by the fact that lice attach their eggs to the hairs at a point close to the skin, so that they are not easily seen unless the hair is parted to look for them, whereas the bot-flies attach their eggs on the hairs at a point remote from the skin. Bot-flies commonly attach their eggs to the hairs, and especially the long hair of the fore-legs, shoulders, nostrils, chin and mouth, places readily accessible to the mouth of the horse, since the larvæ must get to the stomach of the host. In our experience, lice eggs were most common in the flanks and around the angle of the jaw, the latter a point not accessible to the mouth. The eggs of lice and bot-flies can be further differentiated by the fact that the louse egg is a symmetrical affair, the cap of the egg rounding off the unattached end like the lid of a barrel, while the bot-fly is asymmetrical, the cap of the egg being set obliquely to the longitudinal axis of the egg. The bot-fly egg is transversely striated; the egg of *Hæmatopinus* is finely stippled, the stippled dots being at the intersections of a network of lines; and the egg of *Trichodectes* is smooth. The eggs of *Hæmatopinus asini* are an opaque, creamy white, 1·2 to 1·27 mm. long and 530 to 540 μ thick, measuring mounted specimens and excluding the adhesive mass that attaches the egg to the hair. The eggs of *Trichodectes pilosus* are daintier, more translucent affairs, with an iridescenr sheen, and are smaller, 830 to 880 μ long and 390 μ thick. Louse eggs are usually attached to one hair, but an occasional egg is found attached to two hairs.

A few experiments were undertaken to determine the length of time required for the hatching of *Hæmatopinus* and *Trichodectes*. In these experiments eggs were collected from horses and kept in Petri dishes under atmospheric conditions of humidity and temperature. The humidity factor was not ascertained; the temperature range was the same as that for the longevity experiments, 21° to 31° C. (70° to 88° F.). The length of time the eggs had been on the horse was, of course, unknown, so that the periods obtained only serve to show that eggs may require that much time to hatch; they may require longer.

In the case of *Trichodectes pilosus*, eggs hatched in the course of five or six days. A majority of the eggs remained unopened at the end of fifty days, the young lice being found dead and shrivelled within the shell at the end of that period.

In the case of *Hæmatopinus asini*, eggs hatched in the course of

ten to eighteen or nineteen days. The large majority of the eggs which were unopened when collected remained unopened at the end of fifty days. These unhatched eggs were dissected open with the following findings: About 66 per cent. of the young lice were dead and shrivelled; about 13 per cent. were dead, but well preserved instead of shrivelled; the remainder, about 21 per cent., appeared to have undergone autolysis, the egg content being fluid and unorganised. It appears likely that the failure to hatch on the part of the large majority of the eggs tested is to be attributed to unfavourable incubation conditions rather than to any common tendency to fail to hatch under normal conditions. On the other hand, the examination of large numbers of eggs collected from horses showed a majority of these eggs to be already opened, so that in a given collection of opened and unopened eggs the unopened ones presumably include those functionally incapable of maturing or opening, which defective eggs would persist in the horse for long periods.

The length of time required for maturation of the lice on horses was not ascertained, and I have been unable to find this point covered by definite experiments in the literature available to me. This is data that should be available before one can speak with certainty as to the proper intervals for dipping. Since the dips used kill the lice, but not the " nits," we must know the time required for a female which hatches right after dipping to become mature and deposit eggs, for this is approximately the period during which we may postpone dipping. We must not postpone it until the female has actually deposited eggs. The other time factor concerns the length of time required for eggs to hatch. After the first dipping we must wait until the egg deposited just before that dipping has hatched, in order to kill all the lice emerging from eggs present at the time of the first dipping. The relations of the hatching period and the period of maturation determine the intervals between dippings and the number of times it is necessary to dip. Since the maturation period for horse lice is not known to me, the procedure indicated for dipping, on the strength of the scanty knowledge available, would be as follows: For sucking lice, if animals are only to be dipped twice, dip at intervals of about 3 weeks; if they may be dipped three times, dip at intervals of about 2 weeks, to eliminate the likelihood of a short maturation period resulting in egg production before the latest of the eggs present at the first dipping had hatched. As a rule, however, the sucking lice mature in three or four weeks, according to Herms (1915), and practical experience indicates that two dippings are usually ample for lice. On the other hand, the statement by Herms that sucking lice hatch in five to six days is apparently not true of *H. asini*. The same authority states

that biting lice hatch in five to eight days, which accords very well with our findings, and mature in three to four weeks. Under these conditions, horses should be dipped for biting lice twice at intervals of ten to twenty days, probably two weeks being the safest interval. For two dippings, where both kinds of lice are present, an interval of about twenty days appears to be indicated.

The present w r calls for all available information along the line of lice control.

As noted earlier in this paper, writers habitually discuss treatments of horse lice as though no distinctions between biting lice and sucking lice need be drawn. I take it that this is due in part to the lack of available detailed information, especially in regard to the bionomics of these insects, on which to make distinctions. The small amount of work that we have done suggests that, even in the use of dips, a treatment commonly regarded as equally effective against *Hæmatopinus* or *Trichodectes*, there are differences worth considering not only in the preferred intervals for dipping, but also in regard to the relative resistance to dips and other insecticides. Tests which are yet incomplete and which will be covered in later papers indicate that *Trichodectes* is more resistant to insecticidal treatment than is *Hæmatopinus*.

A distinction between the effects of treatment on sucking lice and on biting lice of horses which does not appear to have been sufficiently emphasised is the fact that even contact insecticides may be simultaneously "stomach poisons" or ingested insecticides for biting lice. When the horse's skin and its hairy covering is soaked with a dip or covered with a contact insecticide of any sort, it contaminates the food of the biting lice, so to speak, and subjects them to any toxic action arising from ingesting these substances. In this way it may happen that biting lice might survive dilutions of contact insecticides that would kill sucking lice, and yet fall victims to these contact insecticides as a result of their actual action as stomach poisons. As matters stand, we would not recognise this action and would regard the death of the biting lice, which might follow the dipping rather closely, as the result of the insecticidal action by contact. This matter deserves investigation.

Along this same line, the writer would like to record the result of tests of an ingested insecticide on horse lice. In the Annual Report of the Chief of the United States Bureau of Entomology, issued in 1916, Dr. L. O. Howard notes that the work done in that bureau has demonstrated that all the species of lice infesting poultry may be readily destroyed by the application of a very small quantity of sodium fluoride. Sodium fluoride is one of the common stomach poisons used in combating such insects as roaches, and is the base of many roach

powders. The method of using sodium fluoride for chickens is given by Bishopp and Wood (1917) as follows: Hold the bird by the legs or wings and put a pinch of sodium fluoride on the head, one on the neck, two on the back, one on the breast, one below the vent, one on the tail, and one scattered on the underside of each wing when spread; or dip the bird in tepid water containing ¾ to 1 ounce of commercial sodium fluoride, or ⅔ of an ounce of the chemically pure material, to each gallon water.

There does not appear to be any reason why sodium fluoride should not be as effective for the biting lice of mammals, species of *Trichodectes*, as for the lice of birds, all of which are biting lice belonging to various genera of Mallophaga. In order to test this, however, one of the two horses infested with biting lice was treated with sodium fluoride, the powder being taken in handfuls and rubbed into the hair practically all over the body. The horse was treated with a contact insecticide. Both horses were very lousy before treatment and both were completely freed of lice by their treatments. A number of other horses infested with sucking lice were also treated with sodium fluoride, while others were treated with various contact insecticides. The sodium fluoride treatment, as was expected, was not successful in destroying sucking lice. While a single experiment with one horse would not of itself establish the efficacy of a treatment, the fact that this success is in accord with the other known facts in regard to biting lice and their treatment makes a rather strong case for this treatment, and without caring to say that its value is established beyond question, we have no hesitancy in saying that it is probably as effective as the experiment indicates and is worthy of trial.

The sodium fluoride treatment has the advantage of being applicable in winter and it apparently does not injure the hair or skin. It has the disadvantage that it is only applicable to biting lice and that a horse covered with powder is not very attractive or even useful in some ways for the time being.

Methods for the control of lice are of special interest at this time. The bringing together of large numbers of horses from all sorts of places in war times habitually results in a rapid spread of these pests and great annoyance to the horses. This, in time, results in trouble for the cavalry and field artillery and work for the army veterinarian.

Obviously, the first control measure is directed against the lice present with a view to killing them. Lice are not especially difficult to kill. The coal-tar dips are cheap and effective, and are the things most commonly used in this country. The Prussian army uses the following: Infusion of tobacco (1 to 25 or 30), with or without the addition of vinegar, which treatment has the disadvantage of being

poisonous; sabadilla vinegar, also poisonous, and to be used well rubbed in at infested spots only; fish oil, which may be used in the same way; 1 part of petroleum to 10 of methylated spirit; equal parts of petroleum and rape-seed oil; 2 to 3 per cent. watery solution of creolin or 3 per cent. solution of liquor cresolis compound; grey mercury ointment, not over 150 grains at one application, rubbed over the entire body, either alone or mixed with oil or soft soap, taking care to keep it out of the eyes; or, in case of need, washing the horse with soapy water and, while the coat is still damp, dusting in finely sifted beech ashes or peat ashes and brushing well in. Inasmuch as soap is a good insecticide of itself, it is likely that some relief could be obtained by the use of strong soap-suds if nothing better was available. Louse powders, containing oxytoluol, crude cresol, naphthalin, pyrethrum, sulphur, and other more or less insecticidal substances, may be used. They have the advantage of being available in winter weather when dips cannot be safely used as a rule; they have the disadvantage noted in the discussion of sodium fluoride of temporarily detracting from a horse's attractiveness and usefulness, and are not such effective and simple contact insecticides as dips. The sodium fluoride treatment, as already noted, may be used against biting lice.

Aside from killing the lice present, there are certain prophylactive and adjuvant measures of value. Clipping horses is a great aid in lice control. Plenty of brushing and currying is another aid. Dipping the curry comb and brush in kerosene or a strong coal-tar dip when leaving one horse and passing to another is a measure of value in preventing the spread of lice; due regard must be had for the potential danger of kerosene as a source of fire loss in a stable, and for the fact that kerosene is depilatory for horses. Also, too strong coal-tar preparations irritate the skin. Shake off the excess kerosene or coal-tar preparation after dipping the comb or brush. Where horses can be curried on a picket line, it diminishes the danger of reinfection from lice and eggs which are cleaned off, since these are more apt to perish out of doors and not return to their hosts than would be the case with lice in a stable. It also diminishes the fire risk in using kerosene. The danger of transmitting lice on saddle blankets, horse blankets, and bridles has not been well investigated or reported; the danger exists, but it is uncertain whether it is considerable or negligible. To be on the safe side, these things should be regarded as carriers of infestation and treated accordingly. Cleanliness is almost always valuable in the control of parasites. Clean stables, frequently whitewashed or washed down with preparations of germicidal and insecticidal character are safer than dirty stables. The prompt and frequent removal of manure and stable litter is a measure of value.

Segregation of badly-infested horses and quarantine measures for new animals are measures that are indicated when feasible.

It is interesting to note that a number of European investigators have stated that one way to remove the human body louse from clothing is to put the clothing on a horse. Some writers advance the theory that there is something insecticidal about this treatment and about horses. One of these writers makes the following statements: Lice are rare on horses; baker's assistants protect themselves against fleas by putting their sleeping clothes with the coats of the stable hands; the Ruthenian people put their clothing over horses to get rid of lice; dogs roll in horse manure to get rid of fleas. Another writer surmises that the efficacy of the system of putting the clothing on horses is not due to a repellent odour, as stated by some, but to the lice abandoning the clothing to get on the horse for warmth and nutrition, and then perhaps being killed by the impalpable and irritant powder from the skin. These surmises are interesting without being entirely convincing. Having seen thousands of lice swarming over horses, it is hard for us to believe that a horse is an insecticide. Still it is conceivable that the human louse (Nuttall states that there is no dependable morphological difference between the head louse and the body or clothes louse), if transplanted to a horse, might die of something akin to gastralgia, or even nostalgia.

In conclusion, I would like to acknowledge the courteous assistance and co-operation of Dr. R. H. Wilson and Dr. L. A. Maze in the conduct of the experiments noted here.

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AN INTRADERMAL TEST FOR BACTERIUM PULLORUM INFECTION IN FOWLS.

By ARCHIBALD R. WARD and BERNARD A. GALLAGHAR,
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Dissemination of Infection in White Diarrhœa.

Of the numerous diseases to which poultry are susceptible it is safe to say that bacillary white diarrhœa is by far the most widespread and most destructive. Its ravages are confined principally to baby chicks, but it is the pullorum infection in the hen which is directly responsible for outbreaks of white diarrhœa in the chicks, since a certain percentage of her eggs hatch infected chicks and the excretions of these spread the disease to the other birds in the brood. The exceedingly high mortality of white diarrhœa, amounting in some cases to almost 100 per cent. of the hatch, practically prevents the rearing of chicks in infected flocks. The disease is contracted during the first four days of life, and deaths occur as a rule during the first month. It has been demonstrated conclusively by several investigators that chicks which recover may carry the causative bacterium in the ovary and serve as a source of infection in the future. Infected hens usually exhibit an ovary containing several angular, hard, discoloured ova; however, the organ may continue to functionate and from time to time an ovum is released which harbours the infective agent. Outbreaks of white diarrhœa as a result of contaminated incubators or brooders could be controlled readily by sanitary measures, but infection through the egg must be prevented by a process of weeding out the carriers among the hens used for breeding.

The Agglutination Test.

Since the presence of the *Bacterium pullorum* in the ovary of the hen is not betrayed by external symptoms, it was necessary to devise a biologic method of diagnosis in order to detect the presence ot the disease in the affected birds. The agglutination test was found to be applicable for this purpose, and several agricultural experiment stations have taken up the work on an extended scale, offering the service to poultrymen at a price that barely covers the cost of the work. This, in Connecticut, is understood to be 10 cents a fowl. The work of drawing blood samples and sending to a laboratory is necessarily tedious and relatively expensive as compared with the value of a bird. A simpler, cheaper, and equally accurate diagnostic method would undoubtedly contribute to greater popularity of this valuable work in disease prevention.

Note.—This bulletin is a report on a study of a disease of fowls that is quite destructive, and should be serviceable to those who are interested in poultry and poultry diseases.

Experimental Work.

The writers have undertaken to determine the possibility of preparing a biological product from *Bacterium pullorum* to be used for the diagnosis of the disease caused by that organism. The general idea was to develop a diagnostic method somewhat analogous to the intradermal tuberculin test, particularly as applied to fowls.

Test of Artificially Infected Birds.

Two strains of *Bacterium pullorum* were planted in 1,500 c.c. of plain bouillon in the amount of one loopful each. This culture was at 37° C. from September 19 to October 19, 1914. It was then placed in the ice box until May 4, 1915. On this date 100 c.c. of the culture was passed through a Berkefeld filter. The filtrate was determined to be sterile by cultural tests. Carbolic acid was then added in sufficient quantity to make a 0·5 per cent. solution.

On May 17, 1915, two drops of this filtrate were injected into the right wattle of a hen that had been infected with *Bacterium pullorum* on September 22, 1914. The liquid was injected slightly above the lower border of the wattle and no attempt was made to place it within the layers of skin. Twenty-four hours later the wattle showed an œdematous swelling. The following day, 48 hours after injection, there was noted a pronounced œdematous infiltration of the entire wattle. A swelling of this size in other intradermal tests would be considered as positive. The temperature was normal. On May 20 the swelling of the wattle decreased considerably, and 90 hours after injection the wattle appeared normal. The wattle of a control, a non-infected bird, injected at the same time, remained normal. On autopsy the ovary of the infected bird presented several angular ova typical of pullorum infection. A pure culture of *B. pullorum* was isolated from the ovary. The result of this experiment suggested that a diagnostic test might be developed.

Work with the same filtrate was continued by evaporating 100 c.c. to one-tenth of its volume in a water bath at the boiling point, the purpose being to test the value of a culture filtrate containing the products of the organism in a more concentrated form.

Twelve fowls were injected intravenously on May 27, 1915, with 1·5 c.c. each of a 48-hour bouillon culture of six strains of *B. pullorum*. About two days after inoculation the fowls showed marked symptoms of illness—pale comb, drowsy attitude, and ruffled feathers. Five of this lot died within a period of 26 days as a result of the infection. On autopsy the following lesions were observed: Livers enlarged. darker than normal, and covered with necrotic foci. Spleens were enlarged and studded with necrotic foci. Ovaries contained irreg-

ular-shaped, hard, dark-coloured ova, typical of pullorum infection. In one case there was severe pericarditis and in another considerable amber-coloured fluid in the peritoneal cavity.

On June 9, thirteen days after the fowls were inoculated and while they still were sick, blood was drawn for serum tests. Of these, fowl 73 was injected in the right wattle with 0·1 c.c. of the concentrated, filtrate. Three hours after injection considerable œdema of the wattle was observed.

Two control fowls, 74 and 75, supposedly healthy birds, each received 0·1 c.c. of the concentrated filtrate in the right wattle. Three hours later they showed œdema of the wattle, practically of the same extent as that shown by the infected bird.

On the next day the swelling of the wattle of the control fowls 74 and 75 had entirely disappeared, while fowl 73 showed considerable swelling. This swelling continued to be marked at the forty-eighth hour, after which it began to subside.

No reaction occurred as a result, and there remained the alternative conclusion that the test was either non-specific or that the reacting controls were infected. Some of the control birds had been secured in the open market, and nothing was known of their previous exposure. Unfortunately control fowl 87, which showed a slight reaction on June 23, died from intercurrent causes and in the absence of the authors was not autopsied. As appears in autopsy notes later, control fowls 88 and 95, which also had reacted, were found to be infected birds.

On August 25 fowls 76, 95, and 96, and a control supposedly negative were killed by bleeding and samples held for agglutination tests. The ovary of fowl 76 contained angular ova typical of pullorum infection, that of fowl 96 dried encapsulated and cysts, not certainly due to pullorum infection, and that of fowl 95 one or two angular ova and two large cysts.

Cultures were made from ovaries of fowls 76 and 95 which yielded growths charateristic of *Bacterium pullorum*, while that from fowl 96 yielded a heavy growth not resembling that of *Bacterium* pullorum. Fowl 76 gave positive agglutination on 0·01 dilution; fowl 95 in 0·002 dilution, while fowl 96 was negative at 0·04 dilution.

An antigen was made from the culture obtained from fowl 96 and tested against the serum of fowl 76, but gave a negative agglutination at 0·04. The result further strengthens the conclusion that the infection in the ovary of fowl 96 was not due to *Bacterium pullorum*. A check was run on the serum of fowl 76 with *Bacillus abortus* as an antigen, with no agglutination resulting. It is seen that fowl 76 although it did not react well to the intradermal test, gave an agglu-

tination of 1 : 100. Also, fowl 95 was undoubtedly infected with *Bacterium pullorum.*

With a view of securing a diagnostic agent that would increase the size of the swelling in the wattle, the writers next tried a product consisting of six strains of *B. pullorum* which had been grown in plain bouillon at a temperature of 37·5° C. for one month. The culture was killed by heating at 60° C. for one hour in a water bath and then carbonised to 0·5 per cent. Th organisms were not removed from the medium, and this product was employed in all subsequent tests.

TABLE V.—TESTS WITH KILLED BOUILLON CULTURES.

Fowl No.	Œdema after 3 hours, Sept. 2.	Œdema after 24 hours, Sept. 3.	Œdema after 48 hours, Sept. 4.	Autopsy.	Culture from ovary.	Agglutination 1 : 100.
73	Marked	Marked positive	Positive..	+	+	+
77	Considerable....	Slight	Trace ..	+	+	+
186[1]	Slight	—	—	0	0	0

[1]Control.

On September 2, fowls 73 and 77 and control fowl 186 were injected with 0·1 c.c. As shown in Table V œdema was present at 24 hours in fowls 73 and 77 and entirely absent in control fowl 186.

On September 20 the following birds were injected in the wattle with 0·1 c.c. of the same bacterial product as used in the preceding test : Fowls 73, 77, 78, 79, 81, 82, and controls 55, 74, 88, 89, 90, 92, 97, 98, and 99. The results of the test are shown in Table VI.

TABLE VI.—FURTHER TESTS WITH KILLED BOUILLON CULTURES.

Fowl No.	Œdema after 24 hours, Sept. 21.	Œdema after 48 hours, Sept. 22.	Autopsy.	Culture.	Agglutination 1 : 100.
73	+	+	+	+	+
77	Slight....	Slight....	+	+	+
78	+	do.	+	+	+
79	+	+	+	+	+
81	+	+	?	+	+
82	+	Slight....	?	—	+
55[1]	—	—	0	0	Not tested
74[1]	—	—	—	—	—
88[1]	+	Slight....	+	+	+
89[1]	—	—	—	—	—
90[1]	—	—	0	0	Not tested.
92[1]	—	—	0	0	Do.
99[1]	+	—	—	—	—

[1] Controls.

On September 23, the following fowls were killed by bleeding and blood was saved for agglutination tests. Autopsy notes follow :

Fowl 73. A hard, tumourlike-mass about an inch in diameter is attached to the ovary by fibrous threads and vessels. Other small ova show typical appearance of pullorum infection. *Bacterium pullorum* was recovered in pure culture from the ovary.

Fowl 77. Ovary contains one ovum the size of a pea, having the appearance of an old pullorum ovum. *B. pullorum* was obtained in pure culture.

Fowl 78. One ovum the size of a pea and having characteristic colour of those with pullorum infection. Also several smaller similar ones and a cyst the size of a hickory nut, which is filled with a colourless fluid. *B. pullorum* was obtained in pure culture from the ovum.

Fowl 79. Ovary contains a number of typical pullorum ova. Pure culture of *B. pullorum* was obtained.

Fowl 81. Ovary contains large ova, apparently normal. There are some small brownish ova that may or may not be infected. Liver contains a few necrotic spots. Cultures from both liver and ovum gave negative results.

Fowl 82. Large ova, apparently normal. Some small brownish ova that may or may not be infected. Liver contains a few whitish spots. Cultures from both liver and ova gave negative results.

On September 24, the following control birds were killed by bleeding, and serum was saved for agglutination tests : Fowls 86, 74, 88, 89, 97, 98, and 99. All were normal, and cultures were negative except for fowl 88, which had reacted to the wattle test. This bird was found to possess a typical pullorum ovary, and yielded a pure culture of *Bacterium pullorum*.

Summary of the Tests with Artificially Infected Birds.

In the course of the experiments, 32 birds that had been exposed to infection by injection of live cultures were employed. When tested for the first time 29 of these, or 90 per cent., revealed œdematous swellings rated as either slight or positive at 24 hours after injection with the diagnostic agent. When read at a 48-hour interval, 23, or 71 per cent. of the same birds gave reactions rated as either slight or positive. Thus, the 24-hour interval yielded the largest percentage of reactions. Practically all birds, both those inoculated and controls, exhibited a swelling shortly after injection, and therefore no diagnostic value has been attributed to swellings observed before the lapse of 24 hours.

Three birds gave negative readings at both 24 and 48 hours. Autopsy of two of these revealed unquestionable lesions of pullorum infection, from which the organisms were obtained, while in the third one the lesions were questionable and no culture was obtained. Thus the test failed to detect 6 per cent. of the birds in which lesions were found.

In all but two cases the same birds were re-tested after an interval of 7 or 8 weeks. Of the 30 birds re-tested 22, or 73 per cent., gave a

reaction rated as either a trace, slight or positive, at 24 hours on the second test. At 48 hours on the second test only 8, or 26 per cent., displayed reactions rated as a trace, slight, or positive. Further, 8 birds, or 26 per cent., showed no reaction at either 24 or 48 hours. It is evident that a re-test after an interval of about 8 weeks is far less reliable than a first test.

Of the 32 birds tested, autopsy revealed unquestionable lesions in 18, or 56 per cent. In 8, or 25 per cent., the lesions were regarded as questionable. In 6 birds, or 16 per cent., no lesions were found, although all were positive to the test at 24 hours.

Twenty-six controls were tested for the first time. These had been gathered from various sources and there was no assurance that they were free from infection. Of these, 5 at 24 hours after injection displayed swellings rated as slight or positive and 4 displayed the same condition at 48 hours. At autopsy 2 were found to be infected, and 1 through accident was not examined. No lesions were found at autopsy of 2 ; however, 1 of these came from the same flock as one of the unquestionably infected controls, and had been in the same cage as the infected bird.

While agglutination tests were made on serum drawn from inoculated birds, after injection with the diagnostic agent, and the results appear in the various tables, it is realised that agglutination would naturally be expected as a result of the various injections. We have observed that as a result of the artificial infection with cultures of *Bacterium pullorum*, the agglutinating value of the serum of these birds varied within a wide range. Some birds gave an agglutination at a dilution of 1 : 1,000, while others that had been repeatedly injected with the test fluid gave no agglutination, owing to the strong bacteriolytic of their sera, presumably resulting from the various injections. Negative control birds after one injection with the test fluid gave an agglutination titer of 1 : 50.

The disadvantages of work with artificially infected birds, due to the large amounts of culture injected and to the severe reactions resulting, were thoroughly realised, and work with naturally infected birds was undertaken.

Field Trials of the Intradermal Test.

Through the courtesy of the Connecticut agricultural experiment station, opportunity was afforded to apply the intradermal test to two flocks tested at the same time by Dr. L. F. Rettger by the agglutination method.

One flock of 231 birds injected on February 28, 1916, contained at the time over 40 birds showing more or less evidence of swelling of

the wattles due to frostbite, while six others showed very slight swelling attributed to the same cause. When examined 38 hours after injection none was regarded as showing reaction to the intradermal test. One bird gave a reaction to the agglutination test and was killed by the owner before arrangements were made to retest by the intradermal method. However, the owner had made an autopsy and reported that he regarded the bird as infected.

In the second flock in which work was done the Conecticut Agricultural Experiment Station tested 50 birds in the regular routine work of testing. Of these one reacted to the agglutination test and failed to react to the intradermal test when examined 46 hours after injection. A number of birds showed slight abnormal conditions, regarded at the time as due to frostbite, but noted in connection with the problem of determining the least amount of swelling to be regarded as a significant intradermal reaction, under the conditions in question.

The bird that gave a positive reaction to the agglutination test was retested by both methods about a month later by Dr. Rettger. At 24 hours after injection the wattle was swollen to about 2·5 times normal thickness, and when observed at 48 hours the swelling was 1·5 times normal. An agglutination test made at the same time also gave positive results. It is probable that the failure of the intradermal test when used the first time was due to some error in technique. Further, it is the belief of the writers that readings should be taken at about 24 hours, and not as late as 36 and 48 hours, as in these trials.

In the same flock the intradermal test alone was applied to about 100 birds, and those showing any enlargement of the wattle at 46 hours were tested by the agglutination method by Dr. Rettger. The size of the swelling following the intradermal injection is indicated as nearly as possible by arranging them in order of decreasing size from the top to the bottom of the list. Here, again, cognisance was taken of every degree of swelling, without implying that the slighter swellings were significant.

TABLE VII.—COMPARISON OF INTRADERMAL AND AGGLUTINATION TESTS.

Fowl No.	Intradermal test.	Agglutination test.	Fowl No.	Intradermal test.	Agglutination test.
93	Whole wattle swollen, ×3 droops	—	66	Swelling and drooping of feathered skin at edge of wattle	—
76	Whole wattle swollen, ×3	+			
77	Lower half swollen, ×3.....	+	52	Trace of swelling at lower edge of wattle	—
73	Swollen, ×2.....	—			
72	Swollen, ×2.....	(?)	99	Swelling possibly due to traumatism, as wattle is very blue ..	—
96	Swollen, ×2.....	—			
29	Lower half swollen, ×2	—	60	Questionable swelling of feathered skin at edge of wattle	?+
59	Lower half swollen, ×1·5.....	—			
81	Lower half swollen, ×1·5.....	—	95	Trace of swelling on posterior half of wattle	—
100	Lower half swollen, ×1·5.....	—			
97	Lower half swollen, ×1·5.....	—			

The results were particularly discordant in the case of fowl 93, which had been placed at the top of the list as showing the best intradermal reaction, while it failed to give a reaction to the agglutination test. In view of the discrepancy, Dr. Rettger obtained the bird in question, together with three others, for retest and autopsy. The results are shown in Table IX :

TABLE IX.—COMPARISON OF RE-TESTS AND AUTOPSY FINDINGS.

Fowl No.	Intradermal test.		Agglutination test.	Condition of ovaries at autopsy.
	24 hours.	48 hours		
93.....	Slight	—	—	Normal
72.....	Swollen, + 2 ..	Swollen + 15 ..	—	Do.
29.....	—	—	—	Normal (small)
60.....	—	—	—	Normal

The result of the re-test and autopsy of birds 93 and 72 is not wholly satisfactory. The repetition of the reaction in both cases is significant, but, on the other hand, the results of the agglutination test and autopsy leaves the matter inconclusive.

TRIALS BY OTHER INDIVIDUALS.

In several instances the test product was sent to interested individuals on request. One report on the results was received in which 1,301 birds were tested and 78 gave a positive reaction. The latter were retested by the agglutination method, and 70 gave a positive reaction.

COMPARISON OF RESULTS OF AGGLUTINATION AND INTRADERMAL TESTS ON NATURALLY INFECTED BIRDS.

Through the assistance of Roy E. Jones, we located and purchased 47 birds that had given positive or questionable agglutination tests, applied by the Connecticut Agricultural Experiment Station. These, together with nine controls, were injected for the intradermal test on June 23, 1916, and readings were taken at 24 and 48 hours.

Of the birds reported positive to the agglutination test applied by the Connecticut station, there was total agreement in 28, or 70 per cent. of the cases in that they also gave positive intradermal test as determined 24 hours after injection and displayed unquestionable lesions when eventually slaughtered. Of those reported positive to the agglutination test, 30, or 75 per cent., revealed lesions at autopsy.

Thirty-five birds gave positive reactions to the intradermal test. Autopsy revealed that of these 29, or 83 per cent., possessed undoubted lesions, in 5 the lesions were questionable, and in 1 no lesions occurred. Of those reported positive to the agglutination test, 3 birds, or 7 per cent.

failed to react to the intradermal test, and autopsy revealed no lesions. On the other hand, 2 birds, or 5 per cent., that had given positive agglutination tests, gave negative intradermal tests, and autopsy revealed lesions. Thus, the percentage of absolute failures of each test as judged by the other test and by the autopsy findings were very similar in amount.

Seven birds had given questionable agglutination tests. Of these 3 were negative to the intradermal test and negative at autopsy. One reported questionable gave a positive intradermal reaction and autopsy revealed lesions. The intradermal test on the other 3 yielded positive, negative, and questionable results, respectively, and autopsy of all 3 furnished inconclusive information.

Of the nine controls, one displayed a marked reaction at 24 hours, consisting of a swelling of the wattle to three times its normal thickness. Autopsy revealed undoubted lesions, and a pure culture of *Bacterium pullorum* was isolated from the ovary. Four others displayed traces consisting of swelling of the lower border of the wattle to about twice the normal thickness. On autopsy, one of these was found to contain undoubted lesions and a pure culture of *B. pullorum* was obtained.

The examination of the wattles at 48 hours revealed swellings varying from a trace to positive is only 22 birds, or 46 per cent., of those tested. This result compared with the 28 birds regarded as positive at 24 hours and verified by subsequent autopsy, again indicates that 48 hours is too long to secure all the positive reactions. Among the controls only one displayed any swelling whatsoever, and this case proved an autopsy to be positive.

On June 26 all the 47 birds and 9 controls were reinjected and examined 5 hours later. At this time every bird, including controls, displayed a swelling varying in the different individuals from a trace to five times the normal thickness. The observation merely emphasises the fact of the occurrence of a non-significant swelling following injection with the diagnostic agent.

At 24 hours 39 birds displayed swelling of the wattle varying from a trace to enlargement to five times the normal thickness. Autopsy revealed undoubted lesions in 30 of these, questionable lesions in seven, and no lesions in two. Total agreement between the results of this reading, the agglutination test, and autopsy findings occurred in 70 per cent. of the birds tested. In two cases, or 4 per cent. of the birds, the positive readings by the agglutination test were not supported by the negative results of the intradermal test and the autopsy. In one case, or 2 per cent., negative results of the intradermal test were contradicted by the positive results of agglutination test and autopsy.

Thus, the results yielded by the first and second 24-hour readings of the test on supposedly infected birds vary but little.

The results yielded by the test on the control birds were perfect, as confirmed by the autopsy. The only two birds that displayed traces of swelling proved on autopsy to be infected.

The fact that the results of the agglutination test, intradermal test, and autopsy are in complete agreement in 70 per cent. of the cases, coupled with the fact that the absolute disagreements are very small, indicates that the two tests are equally accurate.

The results obtained at the autopsy of the birds emphasise the difficulty of determining a standard for comparison of the accuracy of the two tests under trial, Thirty-one cases, or 64 per cent., were found to possess unquestionable lesions consisting of the angular ova characteristic of the infection. All of the cases had given positive reactions to one or both tests. In nine cases, or 10 per cent., the autopsy was inconclusive in that there were present only very small dark ova or cysts. Of these nine questionable cases three had given questionable agglutination readings but positive intradermal reactions. In two cases the agglutination and intradermal tests disagreed. In four cases both tests had given positive results.

Significance of Swelling as an Indication of a Reaction.

In determining the significance in diagnosis of an œdematous swelling of a wattle one is confronted with the fact that in all birds such swelling occurs shortly after injection. The problem is to determine the point of time after injection to read the test when this preliminary swelling has disappeared, yet not too late to escape observing a significant œdema. The tests on birds in the laboratory, and probably also those in the field, indicate that 48 hours is too late. While some observations on birds in the field made during freezing weather would indicate that slight swellings should not be considered, yet the entire experience with birds in the laboratory indicates that even a trace may be indicative of a positive reaction. Some few cases would indicate that a 24-hour reading might give false results due to the inclusion of some cases in which the preliminary non-significant swelling had not quite subsided. At present, the 24-hour interval has given the best results, but the examination of a series of readings at 30 hours would be desirable.

Various Biologic Tests.

During the course of these experiments several attempts were made to produce a reaction to the diagnostic agent by injection into the comb, but no satisfactory results were obtained. The ophthalmic, palpebral, and subcutaneous tests also failed to produce a reaction.

Also limited complement-fixation tests on the blood serum of infected fowls gave uncertain readings.

Summary and Conclusions.

A killed culture of *Bacterium pullorum* grown for about a month and held for several weeks before use and without further treatment other than carbolising, has given the most satisfactory results.

It seems to be a fact that the œdematous swelling resulting from the injection of this product into the wattle of a fowl, when observed at a proper time interval, is an indication of the presence of infection of *B. pullorum* in the fowl.

Our experience to date with readings at various time intervals leads to the conclusion that the 24-hour interval has given the most accurate results. However, it seems desirable to test on a large number of birds the accuracy of readings made at a slightly longer interval.

The weight of evidence indicates that any perceptible swelling of the wattle should be regarded as significant. A second intradermal test made at an interval of four days gave results varying but little from the first test. Others made at intervals up to two months gave less accurate results the second time. Thus, there is no advantage in retesting.

Of birds artificially infected with the disease and tested in the laboratory, in round numbers 90 per cent. gave positive reactions ; and in 6 per cent. the test failed to indicate a reaction when lesions were present. In 3 per cent. no reaction occurred and no lesions were present.

In a field test on 231 birds made simultaneously with the agglutination test, the intradermal test at 38 hours failed to detect one case reported positive to the other test. In a second flock of 50 birds in which the two tests were compared, the intradermal test when read at 46 hours failed to indicate one case that was detected by the agglutination test. Another group of about 100 birds tested under unfavourable conditions gave less satisfactory results.

Forty-seven birds that had been tested by the agglutination method by the Connecticut Agricultural Experiment Station in the field were purchased for experiments with the intradermal test. Of these, 40 had given positive reactions to the agglutination test and seven doubtful reactions. There was complete agreement between the agglutination test, the intradermal test, and autopsy findings in 70 per cent. of the cases. The agglutination test reported positive in three cases, or 7 per cent., was not confirmed by the intradermal test nor by the autopsy findings. The result of the intradermal test was negative in two cases, or 5 per cent., when it was not confirmed by the positive

agglutination test and autopsy findings. Thus the percentage of absolute failures of each test was small and very similar for both tests.

Autopsy does not furnish an absolute standard for comparing the accuracy of tests. Seventy-two per cent. only of naturally infected birds that had reacted to one or both tests were found on autopsy to be unmistakably infected.

The intradermal test detected the presence of infection in four of the 34 control birds injected in connection with the tests in the laboratory on artificially and naturally infected birds.

In a field trial not made by the writers, 1,301 birds were tested intradermally and 78 reacted. Of these 70 reacted to the agglutination test made subsequently.

The intradermal test has already shown sufficient promise to warrant further extensive trials in the field in comparison with the agglutination test.—*Bulletin* 517, *U.S.A. Dept. of Agriculture.*

HOG CHOLERA.

THE experience of past years having proved conclusively that the feeding of uncooked garbage is a frequent cause of hog cholera, and has been responsible for many serious outbreaks of the disease, it was decided to limit this practice to those who are willing to cook the garbage and to maintain their hog pens in a sanitary condition.

The following regulation was passed and is now law :—

> "The feeding of swine upon garbage, either raw or cooked, obtained elsewhere than on the premises where fed, is prohibited, unless special permission in writing is first obtained from the Veterinary Director General."

Following the passing of this regulation, our inspectors have endeavoured to have all persons engaged in the business of garbage feeding apply for a licence to continue the same. No charge is made for a licence, but licences are issued only to persons having the necessary appliances for cooking the garbage, and who maintain their premises in a sanitary manner.

A large number of licences have been issued, and the supervision which this system enables us to exercise over this business is already showing good results. No prosecutions have yet been undertaken of parties who continue to feed garbage without a licence, but it will probably be necessary to do so unless the law is generally obeyed.

Another important change in our method of handling hog cholera has resulted in reducing the losses from the disease to a considerable extent. This is the use of serum to save as many as possible of the hogs in an outbreak. We are using the "serum alone" method to

immunise hogs which have been exposed to infection, but have not yet developed the symptoms of the disease. Under former methods, these hogs were slaughtered and their carcasses destroyed, so as to stamp out the infection as soon as possible. Now we are able to save a large number of hogs which are fattened under quarantine, and subsequently slaughtered under inspection for pork. We are not permitting these immunised hogs to remain alive for breeding purposes, as it is likely that some of them may be immune carriers of the disease and thus originate fresh outbreaks.

The serum is injected by our own inspectors without cost to the farmer, and the serum is obtained from highly-recommended manufacturers in the United States. For many reasons this appears to be more desirable at present than to engage in its manufacture at our laboratory here.—*Report of Veterinary Director General for Canada*

NEW MODE OF FISHING.

Scrap Book (Printed by John Pierpont, Boston, Author of "Airs of Palestine), published 1818.

"SEVERAL years ago, a farmer who resided in the immediate neighbourhood of Lochmaben, Dumfriesshire, kept a gander, who had not only a great trick of wandering himself, but also delighted in piloting forth his cackling harem to weary themselves in circumnavigating their water lake, or in straying amidst forbidden fields on the opposite shore. Wishing to check this vagrant habit, he one day seized the gander just as he was about to spring into his favourite element, and tying a large fish-hook to his leg, to which was attached part of a dead frog, he suffered him to proceed upon his voyage of discovery. As had been anticipated, this bait soon caught the eye of a greedy pike, which, swallowing the deadly hook, not only arrested the progress of the astonished gander, but forced him to perform half a dozen somersaults on the surface of the water. For some time the struggle was most amusing, the fish pulling and the bird screaming with all its might, the one attempting to fly and the other to swim, from the invisible enemy, the gander the one moment losing and the next regaining his centre of gravity, and casting between whiles many a rueful look at his snow-white fleet of geese and goslings, who cackled forth their sympathy for their afflicted commodore. At length victory declared in favour of the feathered angler, who, bearing away for the nearest shore, landed on the smooth, green grass one of the finest pike ever caught in the Castle loch. This adventure is said to have cured the gander of his propensity for wandering; but on this point we are inclined to be a little sceptical—particularly as we lately

heard that, at the reservoir near Glasgow, the country people are in the habit of employing ducks in this novel mode of fishing. We cannot, to be sure, vouch for this last fact ; but in the days of yore hawks were taught to bring down woodcock and muirfowl, and why might not a similar course of training enable ducks to bring up pike and perch ? "

CODE OF ETHICS FOR MEMBERS OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION.

Section 1.—Members of this Association are expected to conduct themselves at all times as professional gentlemen. Any flagrant violation of this principle shall be considered by this Association as unprofessional conduct, and on written charges filed with the Executive Board may subject the violator to suspension or expulsion as provided in Article 5, Section 7, of the Constitution.

Section 2.—No member shall assume a title to which he has not a just claim.

Section 3.—No member shall endeavour to build up a practice by undercharging another practitioner.

Section 4.—In all cases of consultation it shall be the duty of the veterinary surgeon in attendance upon the case to give the opinion of the consulting veterinary surgeon (whether favourable to his own or otherwise) to the owner of the patient in the presence of all three. In case of the absence of the owner the veterinary surgeon consulted, may, after giving his opinion to the attending veterinary surgeon, transmit it in writing to the owner through the medical attendant. It shall be deemed a breach of this code for a consulting veterinary surgeon to revisit a patient without a special invitation by the attending veterinary surgeon or agreement with him.

Section 5.—In advertising, the veterinary surgeon shall confine himself to his business address. Advertising specific medicines, specific plans of treatment, or advertising through the medium of posters, illustrated stationery, newspaper puffs, etc., will not be countenanced by this Association.

Section 6.—Any person who shall advertise or otherwise offer to the public any medicine, the composition of which he refuses to disclose, or who proposes to cure disease by secret medicines, shall be deemed unworthy of membership in this Association.

Section 7.—It shall be deemed a violation of the code of ethics for any member of this Association to contract with or through the officers of any livestock insurance company for the professional treatment of the members' stock so insured ; but this rule shall not

prevent any member from becoming an examiner of risks and acting in the capacity of an expert for the same.

Section 8.—Each member shall observe the code of ethics adopted by this association and be answerable to the Executive Board for any breach of the same.

URETHRAL CALCULUS.

I RECEIVED a call about 10.30 one night to see a horse very sick with "colic." On my arrival I found a 1,500-pound horse showing symptoms of abdominal pain. This horse was used for light truck work, but as this was Sunday he had made an eight-mile trip to the country, going in the morning and returning that evening, when it was found he refused feed and water. An examination for bowel trouble showed that, if such were the case, it had not reached a stage to cause alarm. Aside from bowel symptoms, there were other very noticeable signs, as violent straining, with protrusion of the penis and dribbling of a few drops of urine. I was told by the attendants that a few weeks previously he had shown some trouble voiding urine, but that after cleaning his sheath this disappeared. On rectal examination the rectum was empty, but I immediately noticed the greatly distended bladder, which, when palpated, caused the animal much pain. Examination of the urethra, so far as was possible in a heavily muscled horse, revealed nothing. On passing the catheter, a hard object was found obstructing the urethra, about seven inches below the arch of the ischium.

A calculus was at once suspected, and the horse was taken to the hospital and prepared for urethrotomy, which was carried out as follows :—

With the subject confined in the stocks and the use of a twitch and a local anesthetic, sufficient restraint was provided. After careful antiseptic precaution, the assistant passed the catheter and held it against the obstruction. A two-inch incision was made directly over the obstruction, which was now easily palpated. The incision was carried on down through the connective tissue and muscles through the urethral wall until the removal of a calculus was effected and the immense quantity of urine was allowed to escape. Drainage was then provided by making the lower termination of the incision, so that the skin incision extended an inch below the opening in the urethra. It was then closed with four interrupted sutures.

Attention is called to this case for three reasons :

1. Because it is a case not seen every day.
2. The operation was performed with the subject standing.

3. It shows how acceptance of the owner's diagnosis or a hasty, careless examination might have been the cause of embarrassment later.

Five weeks later I was called again to see the same horse, and again found a calculus that had passed the location of the first one, so that it had to be removed through an incision in the body of the penis. This calculus was as large, if not larger, than the first, thus showing that the first operation caused no stricture. The horse is now making a nice recovery. I might add that in both instances rectal examinations were negative. The question arises, "How long does it take for a urethral calculus to develop?"—A DOCTOR in the *A. J. V. M.*

Translations.

ON THE TREATMENT OF LYMPHANGITIS IN THE HORSE.

BY VETERINARY MAJOR CHAUSSÉ,

Of the Heavy Artillery Regiment.

THE *R.G.* of October 15 published a very interesting article by Messieurs Haan and Auger on prevalent affections among our effectives during this war. Their rapid extension and spread, as these authors remark, makes it appear certain that quite a number of veterinary surgeons had never met with epizootic and ulcerous lymphangitis before 1914. My intention in publishing these lines is not to disclose or lay claim to any infallible treatment, but to describe a process which I used at Maroc in 1913, and which up to now has given me every satisfaction in localising lesions on a subject affected.

Messieurs Haan and Auger declared in their article that "whatever the drug used by them, they have obtained better results by cauterisation," and they cite the example of Charmoy, who simply surrounds the lesions with a double rank of puncture fire-points, followed by blistering. The process I adopted is on the same lines, but whereas Charmoy puncture fires, I line fire in the following manner :—

1. After having widely clipped the affected region, cauterise the lymphangitic nodes first with a point firing iron, and then with a budding iron.

2. Fix the limit of the cord above and below the nodes (even if the region is other than that of the members) by a very deep firing line with section of the skin. I consider this method is equivalent to the surgical intervention which extirpates the cord, but it does not offer the same inconveniences, deep and extensive sloughing; production

of easily-soiled wounds in the rudimentary establishments often existing on the front.

3. Delimitation of the invaded region by two firing lines not very deep, uniting the two preceding ones and surrounding the part as well as the cord or the lymphangitic nodes.

4. After care, warm antiseptic washes, sulphate of copper solution on the nodes. In the case of localisation on the lower part of a limb (below the knee or the hock) I place above the last ulcer a single circular and very deep firing line—cauterisation of buttons and same treatment as above. Baths of running water when it has been possible to give them have given me excellent results.

5. Renew the firing lines subsequently if it is necessary. On numerous horses and mules which have been submitted to this treatment I have only exceptionally seen the irruption of lesions beyond the limits of the firing lines. An important recommendation to terminate this recital is that *it is necessary to act early* on the appearance of the first bud; cauterise immediately as I have described, and if a second arises, apply the complete treatment.

As a preventive measure I cauterise lightly with the firing iron and in a systematic way all wounds, whatever be their nature, in a subject belonging to any formation where cases of lymphangitis break out. Of course, one naturally takes the sanitary measures prescribed in similar cases—preliminary malleination, isolation, and disinfection.

The process by line firing which I indicate is simple and at the command of all; one can operate on the animal standing or cast, according to the character of the patient; one can supplement it by any internal treatment preferred. For my part I have used for a long time intravenous injections of an isotonic solution of iodide of potassium. Since this drug has gone up to an enormous price, and in view of the difficulty in obtaining it, I have ceased all internal treatment and to my surprise the results have been identical. I attribute them to the early intervention that I practise.

The prognosis in lymphangitis is grave, say Haan and Auger. I am of their opinion, but this gravity is due to slaughtering *en masse* in view of the lesions present on evacuated animals; too tardy evacuations, these authors rightly declare, and which consequently for economic reasons necessitate the sacrifice of the animal.

Haan and Auger urge that the animals be evacuated when the lesions are little extensive. By acting as I have indicated I believe that the end desired will be obtained; it is permissible to attempt the cure of affected horses on the front when one wishes to conserve the

unit on account of its value and in cases of non-success to evacuate them afterwards with lesions localised between limiting firing lines.—*Rev Gén. de Méd. Vét.* G.M.

Reviews.

MEAT INSPECTION PROBLEMS, WITH SPECIAL REFERENCE TO THE DEVELOPMENTS OF RECENT YEARS. By William J. Howarth, M.D., D.P.H., M.O.H. for the City of London. Demy 8vo, pp. viii + 143; illustrations, two. Price 6s. net. Publishers: Baillière, Tindall & Cox, 8, Henrietta Street, London, W.C.

This is an excellent little book, that will probably be well perused and have a good circulation by reason of the clarity and conciseness of the author's remarks on the subject of certain difficulties that arise in meat inspection. In his preface he writes: "Decisions in cases of tuberculous infection are the constant duty of meat inspectors in this country, and in this connection an attempt has been made to furnish a reasoned argument in support of such action as is advised."

There are five chapters and four appendices in the work. Chapters II, III, IV and V were delivered as the Milroy Lectures before the Royal College of Physicians in 1917.

The subject matter deals with the Development of Meat Inspection, General Administrative Problems, the Tuberculosis Problem as Affecting Cattle, the Tuberculosis Problem as Affecting Pigs and Imported Meat. In the Appendices the Lymphatic Glands, the Inspection and Manner of Packing Imported Offal and Boneless Meat, a Note on Certain Conditions, and the Sale of Sterilised Unsound Meat are the subjects dealt with.

Perhaps Chapter II is one of the most important in the book. We think that knowledge as regards meat inspection in this country is considerably ahead of the administrative tendency and inclination to establish widespread and uniform meat inspection or, indeed, to set up any system of universal meat inspection at all. A large part of the book, as is only natural, deals with tuberculosis in cattle and swine, and the author has much that is very interesting and practical to put before his readers. He seems to think that there is little hope of establishing a three-grade system of selling meat in this country, but economic conditions may force us to adopt such a procedure in the future and anyway what is largely done in America, although not quite in the same way as under the Freibruk system in Germany, ought not to be altogether ruled out for this country. We know we are insular in our ideas, but perhaps after the war we shall become more pliable and cosmopolitan. The arguments advanced against the sale of sterilised meat in this country are more prominently put forward than those in favour of it. We think much might to be said on the other side of the question, especially at the present time.

The doctor has certainly produced a book of exceptional interest to veterinary surgeons, meat inspectors, and medical officers of health,

and we trust that many of our body will get the book and read it. Its perusal cannot help but be beneficial to all taking an interest in the subject. G. M.

VETERINARY REVIEW, FEBRUARY, 1918.—Editor: O. Charmock Bradley, M.D., D.S.C., M.R.C.V.S. Issued quarterly, price 3s. 6d. Annual subscription 10s. 6d. Published by W. Green and Son, Ltd., London and Edinburgh.

" Excellent in every way " is the verdict that may again be written on the *Veterinary Review*. It contains an article by Sir William Osler entitled " Essaide Bibliographie Hippique," which is very timely and appropriate, and coming from such an authority it is especially gratifying and encouraging to us. The author indicates the chief reasou why we have never attained the high plane reached by the veterinary profession in France. The writing is really a review of a book published after fifteen years' labour by General Mennessier de la Lance, which gives a detailed description of the works published or translated in Latin or French on the Cavalry Horse. Another article, which is anonymous, on " The Birth of Modern Surgery," is well worth reading.

The review contains 138 pages, comprising, besides the papers previously named, abstracts, reports, reviews, notes on books, and a bibliography.

All those who wish to keep up to date in conversance with modern thought and literature bearing on veterinary matters must take the *Review*. There is not a domain in our activities that is not touched upon by it, and it ought to stimulate beyond measure that progress and real life among us that we all desire, but do not all take measures to further. G. M.

NOTICES.

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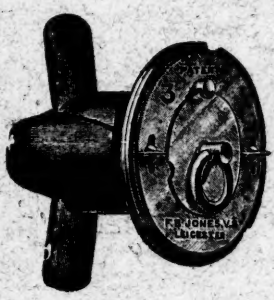

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